United States Department of the Interior

FISH AND WILDLIFE SERVICE
P.O. Box 1306
Albuquerque, New Mexico 87103

In Reply Refer To:
R2/88-SE

2-21-94-F-244

JUL 1 1994

MEMORANDUM

To: Assistant Regional Director, Fisheries and Federal Assistance

From: Regional Director, Region 2

Subject: Biological Opinion on Fish and Wildlife Service Stocking of Rainbow Trout and Channel Catfish in the Lower Colorado River (Hoover Dam to the International Border)

This responds to your request of March 7, 1994, for formal section 7 consultation pursuant to the Endangered Species Act (Act) of 1973, as amended, on the stocking of rainbow trout (Oncorhynchus mykiss) produced in the Willow Beach National Fish Hatchery by the Fish and Wildlife Service (Service) in specified locations in or along the lower Colorado River below Hoover Dam. The request also included the stocking of channel catfish (Ictalurus punctatus) in waters isolated from the mainstem lower Colorado River and connected backwaters. The species of concern in this consultation include the razorback sucker (Xyrauchen texanus) and bonytail chub (Gila elegans). Designated critical habitat for the razorback sucker in Lake Mohave and the Parker Strip, and for the bonytail chub in Lake Mohave and Lake Havasu would also be affected by the proposed action.

The project area encompasses portions of Mohave, La Paz, and Yuma Counties in Arizona; Riverside, San Bernadino, and Imperial Counties in California; and Clark County in Nevada. The 90-day consultation period began on March 9, 1994, the date your request was received by the Ecological Services State Office in Arizona (AESO).

This biological opinion was prepared using information contained in the intraservice section 7 evaluation form, data in our files or in the published or grey literature, and other sources of information.

BIOLOGICAL OPINION

It is my biological opinion that the continuing Service program to stock rainbow trout in specified locations in the river and certain specified impoundments along the lower Colorado River is not likely to jeopardize the continued existence of the endangered razorback sucker and bonytail chub. Designated critical habitat for these two fish species in the lower Colorado River is not likely to be adversely modified by the stocking of rainbow trout in the areas where stocking is proposed.

It is my biological opinion that the stocking of channel catfish in tanks and other waters with no direct connection to the lower Colorado River is not likely to adversely affect the razorback sucker and bonytail chub or their designated critical habitat.

BACKGROUND INFORMATION

Consultation History

The Service's Fisheries Resources program in Region 2 is the action agency in this consultation. Willow Beach National Fish Hatchery raises rainbow trout for stocking waters on Federal, tribal, and other lands along the lower Colorado River. Channel catfish used in the program are obtained from Service hatcheries in Texas. On Service and Native American Trust lands, the Arizona Fisheries Resources Offices in Pinetop and Parker, Arizona, provides technical management assistance for these recreational fisheries programs.

Although the stocking of rainbow trout and channel catfish by Service programs has been occurring for many years, section 7 consultation was not initiated prior to 1980 due to the lack of listed species in the lower Colorado River that could be adversely affected by the action. Consultation on this activity was not initiated when the bonytail chub was listed in 1980 nor when the razorback sucker was listed in 1991. This stocking program was part of the initial Fisheries and Federal Aid informal section 7 consultation in 1992. Because of the need to resolve this particular issue, the Service determined in 1994 that separate consultation on this activity was appropriate and a biological evaluation (BE) was developed by the Arizona Fishery Resources Office (AZFRO) and transmitted to the AESO.

The 1994 BE contained basic information on the rainbow trout stocking program. This was in the form of a table with general locations, numbers of fish, and the date of the proposed stocking. Maps of only some locations were provided, and the locations of the actual stocking (i.e., mid-channel, in backwaters, coves or open water) were not provided. Reference to the 1992 BE was made to provide this information. Information on channel catfish stocking locations was also not provided in the 1994 BE but was in the 1992 BE.

There is not a complete overlap in rainbow trout stocking locations between the two BE's. The AESO assumes that only those sites in the 1994 BE will be part of the present consultation. The AESO also assumes that all locations listed in the 1994 BE are to be evaluated as part of this action, regardless of whether that location was stocked in 1994 or not. This assumption will allow for a full examination of the effects of the lower Colorado River stocking program during this consultation. It is also assumed that the general numbers of fish and proposed stocking dates are similar to those from previous years and represents the probable program direction for at least the next few years. The AESO also assumes that the stocking of all fish in a specified location for a particular month was done on one day of that month and in one or more generalized locations.

Description of the Action

The proposed action is the continuation of the rainbow trout and channel catfish stocking programs by the Service in specific locations along the lower Colorado River. This action is undertaken as part of the Service's trust responsibility for Native Americans and to meet State and Federal goals for recreational sport fishing opportunities on the lower Colorado River. Proposed actions regarding stocking of bonytail chub and razorback sucker is to further recovery efforts for these two endangered species.

Rainbow trout

The 1994 BE provided monthly stocking levels for rainbow trout for all areas to be included in this consultation. Information in the following discussion was summarized from those tables. Please refer to the BE for more specific information.

The Service proposes to stock a total of 560,500-8 to 10 inch (300 to 400 mm) catchable rainbow trout into Lake Mohave (areas 1-7), the mainstem Colorado River below Davis Dam (areas C1-C7) (this area includes portions of the Fort Mohave Indian Reservation), near Needles, California, four areas on the Colorado River Indian Reservation (12-Mile and Deer Island Lakes, Moovalya Pond and Rock Drop), and two areas on the Fort Yuma Indian Reservation (Alamo and Forebay canals). The stocking program for each area is described below.

Below Davis Dam a total of 146,000 rainbow trout were proposed to be stocked between August and May. No stockings were proposed for June and July. Stocking efforts are not evenly distributed over the area or over time. The Needles area received concentrated stockings (20,000 each) in April and May. The area immediately below Davis Dam also received 12,000 fish in April but no fish were distributed throughout the entire reach at that time. The Needles area also receives the first stocking of the fall, in August (10,000 fish), with Davis Dam

receiving 12,000 fish in September. From October to March, 12,000 fish each month are distributed throughout the entire reach.

The four stocking areas on the Colorado River Indian Reservation are small ponds or lakes along the river. These are all winter only fisheries, with stockings monthly from November to March. Stocking levels vary from 1,200 fish each month at Deer Island Lake, 600 a month at 12-Mile Lake, and 400 a month at both Moovalya Pond and Rock Drop. A total of 13,000 fish are committed to the reservation.

The stocking program on the Fort Yuma Indian Reservation comprises two areas that receive two stockings per season. Alamo Canal receives 1,500 fish in November and 3,000 in January. The Forebay Canal receives 4,000 fish divided equally into a November and a January stocking. A total of 8,500 fish are committed to the reservation.

The largest stocking effort is in Lake Mohave. For stocking purposes, the reservoir has been divided into seven areas. Area 1 begins at Davis Dam and Area 7 ends at Hoover Dam. Based on stocking patterns, the reservoir can be separated into three zones. Beginning and end points for the zones are only approximate since definitive maps were not provided.

Areas 1 and 2 are the most downstream portion of the reservoir and form one zone from Davis Dam to the southern end of Cottonwood Basin. Rainbow trout are only stocked in this zone from November to March. A total of 91,900 fish were proposed for these areas.

Areas 3, 4, and 5 form the second zone. This zone includes Cottonwood Basin and Little Basin (between Arizona and Nevada bays) up to the lower end of Eldorado Canyon. Rainbow trout are stocked in this zone from November to May. A total of 101,600 fish are proposed for these areas. The Service has committed to survey areas 1 through 5 before trout stocking occurs; trout will not be stocked in these areas when razorback sucker larvae are present.

Areas 6 and 7 form the third zone. This is the more riverine section of the reservoir and extends from Eldorado Canyon to near the base of Hoover Dam. In this area, rainbow trout are stocked every month, maintaining a year-round fishery. A total of 199,500 fish are proposed for these areas.

Channel catfish

Of the eight areas identified in the 1992 BE, channel catfish stocking was halted due to proximity to native fish populations in seven areas. The only remaining stocking site mentioned, the Alamo Canal on the Fort Yuma Indian Reservation, is also a rainbow trout site. No information on other sites away from the river or the level of stocking for any site was provided in the 1992 or 1994 BE.

Bonytail chub

Bonytail chub stocking was initiated by the Service in 1981. From its inception this reintroduction effort provided limited numbers of junvenile fish for reintroduction into Lake Mohave. In 1993, fingerling fish were introduced into growout facilities at Lakes Havasu and Mohave for additional growth before their release into the respective lakes. These introductions continue.

Razorback sucker

A major recovery effort was initiated in 1981 to restore razorback sucker to the Gila River drainage. That effort continues with emphasis now placed on larger fish. In 1993, fingerling razorback suckers were also placed in growout facilities at Lakes Havasu and Mohave for additional growth before their release to the lakes. As with bonytail chub reintroductions, the efforts continue. Greater detail for the reintroduction effort for both species may be found in the appendix to this document.

Description of the Project Area

General

The Colorado River watershed includes much of the western United States, reaching from southern Wyoming to Mexico. The Upper Colorado River Basin (Upper Basin) includes the mainstem Colorado and its tributaries down to Lees Ferry, Arizona. The Lower Colorado River Basin (Lower Basin) includes the mainstem Colorado and its tributaries to the Gulf of California. The river in the Lower Basin has been greatly altered by the effects of human development actions. The construction of Hoover Dam and the creation of Lake Mead provided the first radical alteration to the physical parameters of that historic flow. Other dams, diversions, channelization projects followed.

The Bureau of Reclamation has primary control over river operations including water delivery and hydropower generation. Other agencies with significant land or water holdings along the lower Colorado River include the National Park Service, Bureau of Land Management, and the Service. There are also several Indian Reservations along the river. State and private lands are interspersed with Federal and Native American Trust lands.

The lower Colorado River provides water resources for agricultural, municipal, and industrial and other consumptive uses as well as for hydropower and recreation. Flows for fish and wildlife purposes are limited to those where a water right has been defined. Releases from the large reservoirs are made to provide water for diversions downstream and there is some hydropower production. Normally, water is released from Lake Mohave or Lake Havasu in response to downstream demand. The changing level of demand and the timing of releases to optimize hydropower production results in major fluctuations in these releases over daily, weekly, and seasonal cycles. Several reaches of the river have been extensively modified by channelization and other flood control activities. There are areas of more natural channels and backwaters interspersed with developed or modified areas.

Lake Mohave

Lake Mohave was the last of the large mainstem reservoirs in the Lower Basin. Created by the construction of Davis Dam in the early 1950's, it acts as a water storage and regulating facility for releases from Hoover Dam. Lake Mohave is 108 kilometers (km) long and at its widest point, 6.4 km wide with a surface area of 115.0 km^2 and a volume of 2.3 X 10^9 cubic meters (m^3). The hydraulic retention time for water entering the reservoir is 0.24 years, thus the reservoir is more riverine in character throughout, and is best described as a "run of the river" reservoir (Paulson et al. 1980).

Flows from Hoover Dam provide the only significant inflow to Lake Mohave. This water is drawn from the hypolimnion and is a fairly uniform 11-12.5 degrees centigrade throughout the year (Paulson et al. 1980). The upper reaches experience considerable fluctuation in water levels over daily, seasonal and yearly patterns. Hoover Dam is used as a peaking power facility and releases vary with the need for power in the western United States. Flows may vary as much as 38,000 cubic feet per second over the course of a summer day (DOI-USBR 1983) due to power generation needs. Most daily fluctuations are not so extreme. The changing flows, combined with the changing lake elevation of Lake Mohave, cause an oscillation in the location of the cold/warm water interface. This interface is the result of the cold water released from Hoover Dam reaching the warmer reservoir waters. Generally, the interface is located near or within Eldorado Canyon. The cold water becomes an undercurrent and flows downlake until it reaches Davis Dam. As a result, Lake Mohave has a cold hypolimnion in the summer and is nearly isothermic with the incoming river water in the winter. Winter water temperatures may reach 12 to 13 degrees centigrade throughout the reservoir and summer epilimnion temperatures of 29 degrees centigrade sharply contrast with the 15 degrees centigrade in the hypolimnion (Priscu 1978; Paulson et al. 1980).

Lake Mohave supports both warm and cold water fisheries. The cold water fishery dominates in the upper, colder riverine stretches but also occurs in the lower reaches of the reservoir. Even during the summer months, the cold hypolimnion has sufficient dissolved oxygen to support fish, thus a cold water fishery can be maintained year-round even in this area. Warm water species are generally taken from the shallower, warmer surface waters, although striped bass (Morone saxatilis) are also taken by anglers in the colder water downstream from Hoover Dam (Liles 1988).

Rainbow trout are stocked throughout Lake Mohave by both the Service and the State of Nevada. Service stockings are concentrated in the colder, upper zone of the reservoir, with Nevada concentrating in the central areas (Cottonwood Basin). The cold water in the hypolimnion enables at least some trout to summer over anywhere in the reservoir and winter water temperatures in the reservoir are suitable for trout.

Davis Dam to Needles

Water is released from Davis Dam to meet downstream water demand and to generate hydropower. Fluctuations in releases occur on daily, weekly, and seasonal cycles and range from no flow to 1,075 m^3/second. Because water is released from the hypolimnion of Lake Mohave, the tailrace of Davis Dam maintains an average temperature of 12 to 16 degrees centigrade over the year (Minckley 1979). The water gradually warms as it moves downstream toward Needles, reaching highs of at least 16 to 20 degrees centigrade in the summer and fall; however, daily and seasonal variations in volume of water released from the dam result in an irregular pattern of water temperatures through the area (Minckley 1979).

There are several backwaters flanking the main channel in this area, and at least 65 percent of the shoreline has been modified by bank stabilization projects, levees and other control structures, and portions of the area have been dredged. Considerable development is found along the river in the Laughlin/Bullhead City area and at Needles. The upper end of the area, at and immediately below the dam, has a cobble and gravel substrate and clear water. Sands and silts are found more in the lower portions of the area, and the water is less clear.

Both a warm and cold water fishery are maintained in the area. Striped bass are the major warm water component and are found throughout the area. Rainbow trout are stocked throughout the area on a seasonal schedule to avoid periods of high temperature.

Lake Havasu begins approximately 30 km (15 river miles) downstream from the stocking area in the vicinity of Needles. There is no physical barrier to fish movements downstream from the stocking site, so it is appropriate to provide information on Lake Havasu in this biological opinion.

Lake Havasu is a reservoir characterized by wide, shallow basins. Maximum depths throughout the reservoir are approximately 18 meters (m) and annual water level fluctuations average about one meter. The reservoir has a short water retention time (10.6 days at maximum discharge), and this has been shown to suppress thermal stratification (Ridley and Steel 1975 in Minckley 1979). Lake Havasu does not demonstrate a long period of thermal stratification. Winter temperature readings average 11 to 12 degrees centigrade and are consistent throughout the water column. By spring (April to May), readings are between 15 to 17 degrees centigrade and are still consistent in the water column. Surface temperatures begin to increase faster than those at greater depth in June and there is a thermocline by July (27 degrees centigrade surface, 22 degrees centigrade at 7 meters) and August (30 degrees centigrade surface, 22 degrees centigrade at 7 meters) that has broken down by September (Roline and Lieberman 1984). Dissolved oxygen levels are adequate for fish life at all depths, even during the summer stratification (Minckley 1979).

The warm water fishery of Lake Havasu is dominated by striped bass, various sunfish and catfish. Water temperatures in the reservoir are too high to allow

the persistence of cold water species. Rainbow trout are not stocked in the reservoir.

Colorado River Indian Reservation

The reservation is located downstream of Parker Dam. Water released from Lake Havasu comes from the epilimnion and there is no cold tailrace below the dam. Temperatures range from about 11 degrees centigrade in winter to over 25 degrees centigrade in summer. Backwaters, such as Moovalya Pond, are often warmer than the main channel (Minckley 1979).

There are four areas proposed for stocking on the reservation. Of these four, one, 12-Mile Lake, is not adjacent to the lower Colorado River but is located a few miles east. There is a small park and senior citizens facility at the lake and it is maintained by pumped water. Razorback suckers were stocked in this lake in 1993 by Service personnel.

Deer Island Lake was formed from an old oxbow as a mitigation feature for the mainstem channelization project in the river adjacent to the lake. Created by dredging, the lake was designed to create a sport fishery and, thus, has a variety of fish habitats within it. Water enters the lake from the river via an inlet structure.

Located upstream of Headgate Rock Dam, Moovalya Pond is a series of three basins on the west side of the river, and isolated from it by a relatively narrow gravel bar and a long ridge. Water levels are maintained by seepage. The portion of the river in front of the lake is also commonly referred to as "Moovalya Lake" but it is not included in the project area.

Rock Drop is a main irrigation canal located approximately 8 miles south of the town of Parker. Water in the canal is diverted from the lower Colorado River.

All of these sites support a cold water fishery only during the winter. Summer temperatures are not suitable for trout and only warm water species make up the fishery in those months.

Fort Yuma Indian Reservation

The two sites on the reservation are canals that are fed from the lower Colorado River. Much of the river channel in this reach has been heavily modified and flows are significantly depleted. Agricultural return flows are an important component of the flows during some months. Water temperatures can reach almost 30 degrees centigrade during the summer (Minckley 1979). A cold water fishery can be supported here during winter months only.

Species Descriptions

Razorback Sucker

Biological information on the razorback sucker was recently summarized in *Battle Against Extinction* edited by Dr. W.L. Minckley and Dr. James E. Deacon (Minckley et al. 1991) and in the Biological Support Document prepared for the designation of critical habitat for the species (Maddux et al. 1993). The information provided below is summarized from these documents and concentrates on information from the lower Colorado River where possible. For more complete information, please refer to the documents referenced.

The razorback sucker is an endemic fish species of the Colorado River basin. Historically, large populations were found in the mainstem and major tributaries of the lower Colorado River. The species was largely extirpated from the tributary rivers of the Lower Basin by the mid-1950's and survives only in portions of the mainstem. The first record for a razorback sucker from the Grand Canyon reach of the Colorado was a single fish captured at Bright Angel Creek in 1944 (Minckley et al. 1991). Records from the Paria River in 1978-79, (Carothers

and Minckley 1981), river mile 108 in 1984 and at the mouth of the Little Colorado River in 1989-1990 (Dennis Kubly, personal communication to Frank Baucom, USFWS-AESO 1993) represent the most current information.

Razorback suckers were identified in Lake Mead after the dam was completed (Moffett 1943), and it was considered abundant and reproducing well (Wallis 1951). They remained relatively common through the 1960's, but by the 1970's, fewer razorbacks were being observed (McCall 1980 in Minckley 1983). No razorback suckers were taken from the reservoir in the 1980's, but were reported again in the 1990's. Spawning adults have been reported from the Vegas Wash area of the reservoir (unpublished data, Nevada Department of Wildlife).

Lake Mohave contains the largest population of razorback suckers anywhere in the Colorado River basin. Individuals have been observed or captured over most of the reservoir at various times. Estimates from the late 1980's put the population at approximately 60,000 individuals; however, more recent estimates show a decline to approximately 20,000 adult fish (Dr. Paul C. Marsh, Arizona State University). The likely cause of the decline is the increasing mortality of old adults that make up this population.

Annual surveys of spawning razorback suckers in Lake Mohave have shown there are at least three areas of spawning concentrations. The areas around Cottonwood Cove, Arizona Bay, Six Mile Cove, and in Eldorado Canyon contain coves and bays where razorback suckers have been observed spawning and where larvae can be found. Razorback suckers are found in other areas of the reservoir, for example around Arrowhead Cove near Katherine's Landing, but large spawning concentrations have not been found in these areas.

The situation in Lake Havasu is similar to that in Lake Mead in that populations observed shortly after impoundment have declined and almost disappeared. However, while razorback suckers are again being reported from field surveys in Lake Mead, the Lake Havasu population still appears to be declining and approaching extinction. The persistence of razorback sucker in Lake Havasu was questionable since there were very few reports of the species in the 1970's to early 1980's. The discovery in 1986 of five adults in the Granite Reef Aqueduct that draws water from Lake Havasu indicated the population was still extant. Other studies documented larvae occurring in the reservoir and the aqueduct (USBR 1986, 1988; Marsh and Papoulias 1989 in Minckley et al. 1991) and strengthened the case for persistence of a reproducing population. Increased numbers of razorback suckers collected from Lake Mead may be due to a more extensive sampling effort. The population appears small, success of recruitment efforts remain unknown.

Below Parker Dam, large razorback sucker populations have not been found for at least 50 years. Surveys in the mid-1940's found the species only near the town of Parker, where Dill (1944) reported that local residents remembered the species as being much more abundant than it was in the mid-1940's. There are scattered reports from the 1960's and 1970's, but major surveys in 1974-1976 (Minckley 1979, 1983), 1980-1981 (Loudermilk and Ulmer 1985), and 1983-1987 (Marsh and Minckley 1985, 1987) failed to locate any razorback suckers in the mainstem or backwaters, except for the small number of individuals in Senator Wash Reservoir. Young of the year razorback suckers have been recovered from irrigation canals on the Colorado River Indian Reservation (C.O. Minckley, USFWS-AFRO, unpublished data) in the last few years indicating there are at least a few reproducing adults in the area.

Adult razorback suckers utilize both quiet backwater areas and river channel habitats. Radio telemetry data from adults released into the Verde River showed that the fish used pools and other slow water areas and avoided riffles (Clarkson et al. 1993). Information on non-spawning habitats in reservoirs is limited due to the lack of surveys performed during the remainder of the year.

Jonez and Sumner (1954) reported spawning razorback suckers in Lake Mohave below El Dorado Fishing Camp in Eldorado Canyon during May. Coves with gravel

substrates appeared to be preferred. Observations from more recent surveys indicate that shallow (0.5 to 5.0 meters) gravel, cobble, or bars are used by spawning fish. Ripe males can be found from November to June, with December to March the peak season. Ripe females are found from December to June, and there is a spawning peak beginning in January and lasting through March, sometimes into April (Minckley et al. 1991). Water temperatures are variable, from 10 degrees centigrade to 21 degrees centigrade, and likely reflect the extended spawning period. Spawning may take place at any time of the day or night.

Larval razorback suckers are found in the back of coves and other quiet water areas over a variety of substrates generally in shallow water (less than 2 meters). Shorelines of rivers may also provide nursery habitat. In 1950, approximately 6,600 larvae were captured in shallow water along the edge of the Colorado River at Cottonwood Landing (pre-Lake Mohave). Water temperatures in these areas was 21.7 degrees centigrade to 24.4 degrees centigrade, much warmer than the main river (Sigler and Miller 1963 in Minckley et al. 1991). The larvae are phototaxic at swimup and can be captured at night using lights. Since razorback suckers begin to spawn early in the spring, these are often the only larval fish in these nursery areas at this season.

Bonytail Chub

Less information on the biology and life history of the bonytail chub is available. The recovery plan for the species (USFWS 1990) and the Biological Support Document prepared for the designation of critical habitat for the species (Maddux et al. 1993) contain the most recent information. The summary in this biological opinion was developed from these documents. For more complete information, the reader is referred to the documents referenced.

The bonytail chub was once widespread in the Colorado River Basin and was found in the mainstem and larger tributaries. It disappeared from the interior Arizona tributaries by the mid 1920's and was considered rare in the lower Colorado and Gila Rivers near Yuma in the early 1940's, and was absent in these tributaries by 1950 (Miller 1961). Bonytail chubs were recorded from the river below Glen Canyon Dam in 1963-65 (Maddux et al. 1993). The last record of a bonytail chub in Lake Mead is from 1967 (Roden 1978 in USFWS 1981). Anglers occasionally took bonytail chub from Lake Havasu through the 1950's and 1960's to at least the mid to late 1970's (Minckley 1979).

The bonytail chub population in Lake Mohave was observed in 1950 along sandy areas of the river (Jonez and Sumner 1954). After the reservoir was created, spawning was observed in coves over gravel substrates (Jonez and Sumner 1954). Although few in number, individual bonytail chub have been consistently observed and taken from the reservoir. Between 1974 and 1991, researchers captured 57 bonytail chubs. Additional specimens were taken by anglers personnel (Marsh and Minckley 1991). Most fish were captured during spring surveys. Special efforts to capture additional specimens has not been made. Adult bonytail chub have been taken from the area immediately upstream from Davis Dam to Eldorado Canyon.

Adult bonytail chubs occupy pools and eddies in rivers and the open water areas of reservoirs. Very cold water, such as that coming from Hoover Dam into the upper reaches of Lake Mohave may restrict use of the area by bonytail chubs (Dr. W. L. Minckley, Arizona State University). Capture records from Lake Mohave indicate adult bonytail chubs use spits and gravel bars at the mouth of desert washes at least during the spring. Wagner (1955) reported catching adults in areas of reverse eddy currents over sandy substrates. Habitat use in other seasons is not known.

Spawning has been observed in spring (May) over gravel bars in water up to 10 meters deep (Jonez and Sumner 1954). Bonytail chub spawn successfully on their own in hatchery ponds, implying that other types of spawning habitats may be suitable. The spawning season is considered to last from late spring to early summer (Wagner 1955), although larvae have not been observed.

Little is known about the habits of larval and juvenile bonytail in the wild. Selection of habitats in reservoirs by larval and juvenile fish is unknown.

Environmental Baseline

The environmental baseline serves to define the current status of the listed species and its habitat to provide a measure against which to assess the effects of the action now under consultation. While the baseline must focus on the conditions in the action area, to an extent the analysis must include information on the status of the species throughout its range. Any evaluation of the effects of the action under consultation must be made in the context of the overall status of each affected species.

The environmental baseline has two components. The first is a summary of the past and present impacts of all Federal, State, and private activities in the area of the proposed action, the anticipated impacts of all proposed Federal activities in the action area that have already undergone formal or early section 7 consultation, and the impact of any State or private activities which are contemporaneous with this consultation process.

The second component is a summary of the status of the affected species throughout its range. The effects of any completed or ongoing recovery actions is included, as are conservation actions, reasonable and prudent measures and reasonable and prudent alternatives that have been initiated as a result of completed section 7 consultations.

Past Actions

The lower Colorado River has been subject to the effects of Federal, State, and private activities for about 100 years. The greatest changes have come in the last 60 years, with construction of large dams. Impacts of these human activities along the river have had profound effects on the river, associated riparian and floodplain areas, and the aquatic fauna. Significant changes to seasonal flows and water quality resulted from the storage of water behind Hoover, Davis, and Parker dams. Water diversions and return flows, flood control projects that stabilized river banks and prevented natural meandering by the river, agricultural and urban development, recreational activities, along with the changes in seasonal flows have impaired the ability of the aquatic habitats to support native fish.

In addition to the physical changes to the river system, introductions of fish species not native to the Colorado River basin were made for commercial and recreational purposes. There are only 36 species of fish native to the Colorado River Basin, 64 percent of which are not found outside the basin (Miller 1959; Carlson and Muth 1989). Over 70 species of fish have been introduced to the basin, and while not all introductions have been successful, the majority were and nonnative fish species dominate in nearly all the remaining aquatic habitats. Less physically modified river sections may retain more of the native fish component, but a nonnative component is also present.

Nonnative fish species have been documented to be a major factor in the decline or disappearance of native Colorado River basin fish species (Dill 1944; Jonez and Sumner 1954; Minckley and Deacon 1968; Joseph et al. 1977; Behnke 1980; Minckley 1983; Brooks 1985; Osmundson 1987; Marsh and Brooks 1989; Osmundson and Kaeding 1989 and others). A considerable amount of information on the effects of nonnative fish to native fish species is available. This information was recently summarized in the documentation for the critical habitat designation for razorback sucker, Colorado squawfish, humpback chub, and bonytail (Maddux et al. 1993), and in a recent biological opinion developed by the AESO (2-21-90-F-119) for the Central Arizona Project. Additional information and discussion in these documents is incorporated herein by reference.

For the most part, the physical effects of most Federal activities on aquatic habitat did not undergo section 7 consultation due to the lack of listed fish

species in the area until 1980. Consultations for the endangered Yuma clapper rail (Rallus longirostris yumanensis) have addressed the issues of backwaters and marshes along the lower river and have indirectly provided some protection for fish.

Since the listing of the razorback sucker in 1991, there have been several consultations on the effects of sport fish enhancement programs (placing of brush piles, old Christmas, or citrus trees and human-made habitats) in areas of the lower Colorado River. Generally, these programs have been allowed in areas where razorback sucker populations are currently very low or there was a sufficient area not treated by the project that could be used by native fish. These types of projects are not permanent alterations of the habitat, as decomposition occurs and more lasting structures may be removed. There is some debate over the effect of these structures on sport fish. One view is that the placement of these habitat features increases the survival of young fish, allowing for increases in population and, thus, the amount of fish available to the angler. The other view is that the structures concentrate the existing fish from a larger area, making them easier to find by anglers. In either case, the intention is to increase fishing pressure at these sites (the locations are made public) and provide a larger number of fish harvested by anglers.

Species Status: Razorback Sucker

Razorback sucker populations are declining throughout the remainder of its range. The only large population, in Lake Mohave, has dropped from an estimated 60,000 individuals to 20,000. The decline is expected to continue as the old adults that make up the population continue to die of old age. Successful natural recruitment has not been documented anywhere in the Colorado River basin, although a few young fish have been found in some areas.

Reintroduction efforts, using hatchery reared larvae and fry have been utilized in attempts to restore the razorback sucker to its historic range in the Lower Basin. Similar efforts have not been undertaken in the Upper Basin, although there is a Recovery Implementation Program in place that stresses the preservation of suitable flows to provide habitat for the species.

Beginning in 1981, in a cooperative effort between the Arizona Game and Fish Department (AGFD) and the Service, a 10-year-initiative was begun to stock tributary streams such as the Gila, Salt, and Verde Rivers with young (predominately larvae) razorback suckers. Data taken indicated that predation on the stocked fish was extremely high and survival to adult was very low (Hendrickson 1993). There were recaptures of individual fish, but it was difficult to tell which stocking they were from. The stocking of larger fish (over 250 mm) was initiated in the mid-1980's and has shown greater promise. Except for areas protected from nonnative fish, larvae stocking was discontinued in the late 1990's. Razorback sucker stocked the previous year were found in the Verde River in spring of 1994, and an individual at large in the Salt River for more than 6 months was recently recovered from a flathead catfish stomach (Kirk Young, AGFD, personal communication). Stocking larger fish enhances survival but is no guarantee against predation.

Reintroduction efforts to the Colorado River mainstem have occurred also. During 1986 and 1987 (Langhorst 1988) stocked razorback sucker fry downstream from Parker Dam but the effort was terminated in 1989.

Efforts to get recruitment to the population in Lake Mohave were initiated in 1986. The use of isolated coves or backwaters to rear advance fingerlings (300 millimeter) from larvae continues to be the goal. Initial efforts were not successful, largely due to physical constraints. However, in 1992, larvae were successfully reared in Yuma cove adjacent to Lake Mohave. Some of the juveniles produced were moved to Davis cove for additional growth and 129 advanced fingerlings (minimum length 300 millimeters) were released into Lake Mohave (data from Tom Burke, USBR). In 1993, some 487 advanced fingerlings (minimum length 300 millimeters) were released from ephemerial ponds, similar to Yuma Cove into

Lake Mohave. Survival of these cove-reared fish has been verified. Five of the fish released in 1992 were recaptured during the spring surveys in 1993. During spring surveys in 1994, 10 fish stocked in 1992 or 1993 were recaptured; one of the 10 fish captured in 1994 was released as a 300 millimeter fish and had grown to an adult. The ripe male was assembled with other adult razorback suckers in a spawning aggregation. Efforts to produce and stock 10,000 advanced fingerlings annually into Lake Mohave is continuing. Stocking will occur during the years 1995 through 1999, or until the existing adult population is stabilized at some 25,000 adult fish.

A similar cove rearing program is part of the Lake Havasu Fisheries Improvement Project, a multiagency effort to improve angler access and success rates. The project was initiated in 1993 with a goal of replacing the existing adult population. The goal is to produce 30,000 razorback suckers for release into the reservoir over a 10 year period. No fish from this effort have been released to date. This project includes an equal rearing effort for bonytail chub.

Species Status: Bonytail Chub

The bonytail chub may be the most endangered large fish species in the Colorado River basin. Populations have declined or vanished from most of the species range. Reports of captures from the Upper Basin rivers are sporadic at best, and recruitment is either nonexistent or very low. In the lower Colorado River, bonytail chub can be found in Lake Mohave, and this may be the largest remaining wild population. The presence of one naturally recruited young bonytail in Lake Mohave indicates some amount of successful recruitment occurred sometime in the late 1970's.

Preservation of existing wild stocks through habitat protection and section 7 consultations have gone on in the Upper Basin. Aside from the Lake Havasu project, there have been no completed section 7 consultations in the Lower Basin that involve the species.

Breeding stock for use in reintroduction programs were taken from Lake Mohave during the late 1970's and early 1980's. Stocking of more than 130,000 bonytail chubs (larvae to 165 millimeter juveniles) was accomplished from 1981-1991 (Marsh and Minckley 1991; USFWS stocking data). Eleven of the 39 fish captured between 1981 and 1990 were probably from these reintroductions. This rate of return is promising. During 1993 and 1994, bonytail chub are being placed in growout ponds prior to their release as 250-300 millimeter advanced fingerlings. The goal is to stock 25,000 advanced fingerlings (250-300 millimeter) into Lake Mohave annually during the period 1996-1999.

In Lake Havasu, the first cove prepared under the Fisheries Improvement Project was stocked with bonytails in 1993. Difficulties with the cove barrier resulted in the premature release of some of these fish into the reservoir. Additional efforts are ongoing (Chuck Minckley, Service, AZFRO).

Species Status: Summary

Without supplemental reintroduction of advanced fingerlings, the remaining natural occurring razorback sucker and bonytail chub populations in Lake Mohave are in danger of extinction in the wild, possibly by the early 2000's. The limited amount of recruitment documented for these species throughout their historic range is not adequate to sustain existing populations. Efforts to augment existing lower Colorado River populations of both species show promise. If successful, these efforts will capture much of the genetic variability that presently exists in natural populations. Natural recruitment to the adult razorback population in Lake Mohave has not been documented. Natural recruitment to the bonytail adult population is believed minimal. In the modified riverine habitat (structural and biological) that is now Lake Mohave, recruitment, at least during the short-term, must be augmented with the reintroduction of advanced fingerlings if the two fish species are to survive.

Reestablishment of large razorback sucker populations in the interior rivers of Arizona will likely require many years of effort. Efforts to reestablish bonytail chub in areas of its range away from Lakes Havasu and Mohave will require development of agreements and rules prior to any releases. These may be difficult to develop and opportunities to expand the range of the species may be postponed or deferred as a result.

Rainbow Trout and the Lake Mohave Fishery

In order to fully evaluate the effects of the proposed stocking program on the razorback sucker and bonytail, some background information on the rainbow trout and the fishery it supports is necessary.

Rainbow trout were first introduced into the lower Colorado River in 1922 (USFWS 1980) and formed an important fishery in the cold tailrace of Hoover Dam after their introduction there in 1935. Jonez and Sumner (1954) reported on the rainbow trout fishery in the area that became Lake Mohave between 1940 and 1951. Growth rates for stocked rainbow trout were good and survival rates high enough that large trophy quality fish were taken. The fishery declined in 1952-1953 due to a failure of food sources, but improved again after 1954. In the 1960's and 1970's, the stocked trout continued to show good growth (Roden 1978 in USFWS 1981). AGFD data indicate that the 200mm stocked rainbow trout were growing and returning in the creel at an average of 300-320mm (Liles 1988). Lake Mohave was one of the premier trout fisheries in the western United States. However, by 1990, there were significant decreases in the catch of rainbow trout in Lake Mohave, in some cases as much as 40 percent of past levels (creel data, AGFD). In 1993, the Nevada Division of Wildlife (NDW) stocked 200,000-8 inch rainbow trout in the Cottonwood Basin and has a less than 1 percent return to the creel (Mike Burrell, NDW, unpublished data).

Rainbow trout could be taken virtually anywhere in the reservoir over the entire year due to the cold water in the hypolimnion that provided refuge from the high summer water temperatures. Fish stocked in one area of the reservoir may move considerable distances. In early tagging studies (Jonez and Sumner 1954), 39 percent of the rainbow trout stocked at Willow Beach stayed in the general vicinity while 41 percent moved upstream an average of 4.4 miles and 10 percent moved downstream an average of 10.4 miles. Of those stocked in Eldorado Canyon in the same period, 30% showed an upstream movement averaging 11.2 miles and 40 percent moved downstream an average of 20.8 miles. Recent information from NDW indicates that rainbow trout stocked in the Cottonwood Cove area distribute themselves throughout the Cottonwood Basin (Mike Burrell, NDW, unpublished data).

With the increase in striped bass populations in Lake Mohave, there is now an abundant predator capable of taking the stocked rainbow trout. Preliminary information from a study of the fishery below Hoover Dam showed that of striped bass with food in their stomach at time of capture, 95 percent had been eating rainbow trout (Jody Walters, Arizona Game and Fish Department, personal communication). Similar predation has been reported in the tailrace of Davis Dam (Edwards 1974) and in Lake Mead. Whether this predation is the cause of low survival rates for rainbow trout is still under investigation.

EFFECTS OF THE ACTION

There are several stocking areas included in the proposed action. The types of effects that may occur to the endangered fish are largely the same regardless of the stocking location. There are, however, differences in magnitude and degree of risk that are important to consider. This section will first discuss the effects in general, then each stocking site or group of sites will be evaluated in light of the effects.

Direct and Indirect Effects

Predation

As discussed in the Environmental Baseline, the introduction of nonnative fish species has been a major factor in the decline of native Colorado River basin fish species. Emphasis on the effects of nonnative fish species upon the razorback sucker and bonytail chub (among others) has been on the warmwater species such as channel catfish, flathead catfish (Pylodictus olivaris), largemouth bass (Micropterus salmoides), sunfish (Lepomis spp.), carp (Cyprinus carpio), and other sport or bait fish species. Information from monitoring of razorback stockings or other fisheries research have documented predation on razorback suckers by all the above species. Investigation of the effects of coldwater species such as rainbow trout have been more limited, emphasizing the native trout interactions with the introduced trout species. Recently work, both in the laboratory and in the field, on the effects of rainbow trout on Little Colorado spinedace (Lepidomeda vittata) has been done (Blinn and Runck 1990, 1992; Blinn et al. 1993) that provides evidence of predation by trout on this threatened species.

For the last 13 years, surveys have been made on Lake Mohave to monitor the status of the razorback sucker population. These surveys take place during the spawning period for the razorback sucker (roughly January to April). During efforts to capture razorback sucker larvae in 1992, rainbow trout were observed preying on the larvae (Gordon Mueller, National Biological Survey, unpublished data).

Rainbow trout have been implicated as predators on young humpback chub in the Grand Canyon (Arizona State University, unpublished data). No direct evidence of predation by rainbow trout on bonytail is available.

Available information indicates that rainbow trout consume razorback sucker larvae during the period of swimup when trout and larvae occur in the same area. Consumption of larger razorback fingerlings and bonytail chub by rainbow trout has not been confirmed.

Lake Mohave: Records of numbers of fish of all species captured during the spring surveys for razorback suckers are available (Arizona State University, AZFRO). Rainbow trout of the size stocked in this program are captured in trammel nets along with spawning razorback suckers. They are found in the coves where razorback suckers spawn and where razorback larvae have been collected. The known important razorback sucker spawning sites are in Areas 3, 4, and 5, although it is likely that some spawning occurs in Areas 1 and 2. While razorback suckers in spawning condition are found in the warm waters below hot springs in Areas 6 and 7, any spawning in these areas is likely very limited. Razorback suckers spawn in January to April, the period in which rainbow trout are stocked in Areas 3, 4, and 5. Areas 1 and 2 are stocked from November to March, still within the prime spawning period. Areas 6 and 7 are stocked year-round. Data on the distribution of rainbow trout after stocking indicates that they do not all remain in the area stocked. Survival rates of the stocked trout could have an effect on how far they move in the reservoir and how long the larvae remain accessible. Stocked trout may only live 3 to 4 months (Jody Walter, AGFD, personal communication). There is no specific data on the extent of the predation by rainbow trout on razorback sucker larvae in Lake Mohave, nor is there any data on the significance of this predation in light of the presence of other predators (green sunfish and carp are common in razorback sucker spawning and nursery habitats). Due to the potential for trout predation on razorback sucker larvae, procedures are in place to limit trout stockings to areas where razorback sucker larvae are not present.

The only information on bonytail spawning in Lake Mohave comes from Jonez and Sumner (1954). Spawning was observed in May in Eldorado Canyon.

Davis Dam to Needles: There have been no recent (post 1980) records of either the razorback sucker or bonytail in the stocking area, but there are records and recovery operations ongoing in Lake Havasu below the stocking sites. Stocking takes place near Needles (the closest location to the reservoir) in April, May, and August. Other stockings take place through the fall, winter, and spring. Temperatures in the stocking area are from 12 degrees centigrade to 16 degrees centigrade near the dam, and from 16 degrees centigrade to 20 degrees centigrade in the lower reaches. Temperatures of over 20 degrees centigrade are encountered in the summer. Temperatures in the area are within the range observed for razorback sucker spawning and probably for bonytail chub as well; however, there are no known spawning sites in the stocking area.

There is spawning habitat for both listed fish species in Lake Havasu, downstream of the stocking sites. Lake Havasu is too warm to allow the survival of rainbow trout over the summer. Fishery surveys reviewed in preparing this biological opinion did not record the presence of rainbow trout in the reservoir. Information indicates that the rainbow trout in the Davis Dam to Needles area do not move out of the area due to high temperatures below the Interstate 40 bridge near Topock (Tom Liles, AGFD, personal communication), although in the winter there does not appear to be a temperature prohibition to such movements. Temperatures of 9 degrees centigrade to 15 degrees centigrade have been recorded for the December to March period from Needles to Parker Dam.

The low number of razorback suckers and bonytail in Lake Havasu and the area below Davis Dam reduces the risk of predation since the opportunity to overlap with the rainbow trout in the spring is much smaller. In the same analysis, if predation was to occur, the significance to the endangered fish recruitment would be high. As the population of both endangered species in Lake Havasu increases with the recovery efforts now underway, some species overlap in the stocking area may be identified.

Colorado River Indian Reservation: There are no bonytail in the river below Parker Dam so only effects to razorback sucker will be considered. The population of razorback suckers in the river adjacent to these stocking areas is small but extant. The presence of young razorback suckers in the canals of the reservation is evidence of reproduction occurring somewhere in the system. Razorback suckers are known to utilize backwater habitats very extensively. Backwaters connected to the river, such as Deer Island Lake or some canals, may be seasonally occupied. Although temperatures may be suitable in these backwaters, razorback sucker spawning may not usually take place here because the predominant substrate is silt and gravel bars or shorelines are rare. Backwaters may have more importance as nursery areas for the larvae, but the extent to which such areas are used is not known. Stockings into isolated waters that do not contain razorback suckers avoid the issue of predation. If rainbow trout or razorback suckers can move into and out of a stocking area, as may be the case with Deer Island Lake and the Rock Drop Canal, there is a potential for overlap in the river channel with some risk of predation. Even though the rainbow trout cannot survive over the summer in either the backwaters or the main channel, the stocking is from November to March, and overlaps the spawning period of the razorback sucker.

Stocking into Moovalya Pond likely would not affect the razorback sucker, unless stocked trout are moved from the pond to the river by anglers. Stocking into 12-Mile Lake would not likely affect the wild population of razorback suckers since it is removed from the river. It is being used as a holding facility for young razorbacks that were introduced to the lake in February 1993. These fish were beyond the size that the stocked rainbow trout could prey on.

The size of the razorback sucker population downstream of Parker Dam is likely small and the habitat areas used by individuals are not well known. The low numbers of rainbow trout stocked reduces the numbers of potential escapees. The degree of fishing pressure and natural mortality of the stocked fish also influences the number of fish able to leave the backwater. No data on these issues was available for the preparation of this biological opinion.

Fort Yuma Indian Reservation: There are no razorback suckers or bonytails in the vicinity of these stockings or that could be reached by individual rainbow trout or channel catfish leaving the stocking area. We believe that there is no effect to the endangered fish species from this portion of the project.

Interactions with Other Species

The dynamics of the interactions between the fish species inhabiting a certain area are complex. The addition of a new species, or the augmentation of its population by stocking, has effects on the existing fish populations. In this instance, the stocking of rainbow trout has an influence on the striped bass populations in Lake Mohave and below Davis Dam. The striped bass is a large piscivorous predator that has been known to consume considerable quantities of stocked rainbow trout from the project area. They are strongly implicated in the decline of the rainbow trout fishery in Lake Mead (Allan and Roden 1978) that resulted in the State of Nevada shifting its rainbow trout stocking program to Lake Mohave. Observational data from rainbow trout stocking operations includes reports of striped bass following the stocking barge as it was loaded and as it released fish into the reservoir. Ongoing studies in the upper reaches of Lake Mohave indicate that the striped bass is a significant predator. Predation on rainbow trout by striped bass is also an issue below Davis Dam (Edwards 1974).

The precipitous decline of the threadfin shad (Dorosoma petenense) in Lake Mohave could have been predicted from the experience in Lake Mead with the striped bass. There is little else for the striped bass to prey on in Lake Mohave, and the presence of an abundant supply of stocked rainbow trout may be supporting the striped bass population at the current level. If this food source was removed or reduced, there could be some effect to other potential prey species. It is not clear what that effect would be, since other prey are not considered abundant.

Effects to fish populations also have effects on resources utilized by those populations. For example, the abundance and distribution of both phytoplankton and zooplankton in the reservoir is subject to both physio-chemical and biological influences. If there is a lack of the appropriate plankton for the razorback sucker larvae that is preventing those that survive the initial predation from growing and developing, an alteration in the planktivorous fish species dynamics in the reservoir may have some effect. Whether this effect would be beneficial or harmful is not known.

Adverse Modification of Critical Habitat

Lake Mohave and the lower Colorado River from Parker Dam to Imperial Dam (including the 100-year floodplain) has been designated as critical habitat for the razorback sucker. Lake Mohave and Lake Havasu have been designated as critical habitat for the bonytail. There are effects to the primary constituent elements from this action.

The primary constituent elements defining critical habitat include one for the biological environment. This element addresses, among others, the food supply, predation, and competition components of the habitat. This element has been significantly degraded by the establishment of self-sustaining nonnative fish populations in the habitat of these endangered fish. Lake Mohave contains the largest population of adult razorback suckers known to exist in the wild. However, recruitment from natural reproduction has not been confirmed in the recent past for razorback sucker and minimal for the bonytail chub. Rainbow trout predation on bonytail chub has not been documented. The constituent element was applied to Lake Mohave's contribution to the maintenance of the adult razorback sucker and bonytail chub populations. Continued stocking of rainbow trout has not been shown to adversely affect the adult population of either species. No adverse modification to critical habitat is anticipated from the proposed action.

Effects to Survival and Recovery

The long- or short-term survival of an endangered species may require implementation of recovery actions as well as protection for individuals and the habitat. In cases of special urgency, actions that contribute to adverse conditions reduce the effectiveness of recovery actions that are or could be taken. Congress was very clear in its defining the purposes of the Act. Section 2(b) states:

> "The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved...."

The definition of "conserve" is found in section 3(3):

> "...to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary...."

Stocked rainbow trout do not reproduce in the reservoir, therefore the proposed action is reversible. Should future investigations indicate that trout are having an adverse impact on razorback sucker, bonytail chub, or their critical habitat, stocking can be discontinued. Once stocking ceases, the rainbow trout population will decrease and eventually cease to exist in Lake Mohave.

Cumulative Effects

Cumulative effects are those effects of future State or private activities that have no Federal connection, that are reasonably certain to occur within the action area of the Federal action subject to consultation.

Although there are private and State interests along the lower Colorado River that have no Federal nexus, most of the activities are tied to either Federal water management through Bureau of Reclamation or permits issued under section 404 of the Clean Water Act administered by the Corps of Engineers. These actions are all subject to section 7 of the Act. There are other connections to programs of the National Park Service, Environmental Protection Agency and Bureau of Indian Affairs.

Projects without a Federal nexus may require section 10(a) permits (Habitat Conservation Plans) to comply with section 9 of the Act. The nonfederal entities along the river are presently evaluating the potential benefits and costs of obtaining a section 10 permit to cover their operations.

INCIDENTAL TAKE

Section 9 of the Act, as amended, prohibits the taking (harass, harm, pursue, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species without a special exemption. The concept of harm includes habitat modification and degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding or sheltering. Case law has affirmed that taking does harm to listed threatened species when there is definable injury or death to individuals. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of the agency action, is not considered taking within the bounds of the Act, provided such taking is in compliance with the incidental take statement provided in the biological opinion.

The purpose of the stocking of rainbow trout is not to prey upon the listed endangered fish. The effects of the action result in the incidental take of an unknown number of individuals each year rainbow trout are present in the system. Procedures now in place preclude the stocking of rainbow trout into areas where razorback larvae are known to be present. In addition, procedures are in place to supplement existing razorback and bonytail chub populations. Until factors that limit natural recruitment are understood and corrected, such procedures offer the best hope for the survival of both species.

The level of incidental take will be considered to be exceeded if any of the following conditions occur:

1. If elements under the reasonable and prudent measures are not implemented.

2. If Service-stocked rainbow trout are shown either through surveys or investigations to limit recruitment of razorback suckers, or bonytail chubs or adversely modify critical habitat.

Reasonable and Prudent Measures

The following reasonable and prudent measure is required to reduce the level of incidental take resulting from the stocking of rainbow trout.

1. Efforts to minimize the opportunity for contact between stocked trout and endangered fish will be accomplished as set forth in the following terms and conditions.

Terms and Conditions

The following terms and conditions implement the reasonable and prudent measure described above. Implementation of all terms and conditions is required to be in compliance with section 9 of the Act.

By memorandum dated June 29, 1994 (see appendix), the Service has committed to the following terms and conditions:

1. Census razorback sucker population in Lake Mohave annually.

2. Attempt to locate bonytail chub spawning areas in Lake Mohave.

3. Conduct surveys prior to the stocking of rainbow trout in areas 1-5 where razorback sucker are known to spawn. Period extends from November through April when larvae may be present. Trout stocking will not occur if razorback sucker larvae are found.

4. Provide 10,000 advanced razorback sucker fingerlings (300 millimeter) annually for Lake Mohave (1995-1999).

5. Provide 25,000 advanced bonytail chub fingerlings (250-300 millimeter) annually for Lake Mohave (1996-1999).

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as Service suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species, critical habitat, or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility for the species.

1. The Service should work with other Federal and State agencies and Indian tribes toward inclusion of conservation of the Lake Mohave razorback sucker and bonytail chub populations as one of the main elements in the future Lake Mohave aquatic ecosystem management plan.

2. The Service should review the Lake Mohave conservation elements for razorback suckers and bonytail chubs as important features to be considered in a Lower Colorado River Basin Native Fish Management Plan presently being developed in concert with State and Federal cooperating

agencies. Conservation elements such as location and management of spawning areas, backwater areas, and oxbows should be made available as future partnership options with other entities.

CONCLUSION

This concludes formal section 7 consultation on the stocking of rainbow trout into the lower Colorado River as described in your request for consultation. As required by CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the agency action.

In future communications on this project, please refer to consultation number 2-21-94-F-244. If there are any questions about this biological opinion, please contact the AESO in Arizona at (602) 379-4720.

cc:
Director, Arizona Game and Fish Department, Phoenix, Arizona
Regional Director, Region 9 (AES/TE)
Regional Director, Region 1 (AES)
Regional Director, Region 2 (AES)
Supervisor, Ecological Services Field Office, Reno, Nevada
Supervisor, Ecological Services State Office, Arizona

LITERATURE CITED

Allan, R.C. and D.L. Roden. 1978. Fish of Lake Mead and Lake Mohave. Nevada Department of Wildlife Biological Bulletin 7, 1-105.

Behnke, R.J. 1980. The impacts of habitat alterations on the endangered and threatened fishes of the upper Colorado River basin: a discussion. Pages 182-192 in W.O. Spofford, Jr., A.L Parker, and A.V. Kneese. eds. Energy development in the southwest: problems of water, fish and wildlife in the upper Colorado River basin, vol. 2. Resources for the Future, Research Paper R-18. Washington, D.C.

Blinn, D.W. and C. Runck. 1990. Importance of predation, diet and habitat on the distribution of Lepidomeda vittata: a federally listed species. Report submitted to Coconino National Forest, Flagstaff, Arizona. 47pp.

_____. 1992. Effects of rainbow trout (Oncorhynchus mykiss) predation on Little Colorado spinedace (Lepidomeda vittata). Report submitted to Coconino National Forest, Flagstaff, Arizona. 24pp.

Blinn, D.W., C. Runck, D.A. Clark, and J.N. Rinne. 1993. Effects of rainbow trout predation on Little Colorado spinedace. Transactions of the American Fisheries Society 122:139-143.

Brooks, J.E. 1985. Factors affecting the success of Gila topminnow (Poeciliopsis o. occidentalis) introductions on four Arizona National Forests. Annual report to the U.S. Fish and Wildlife Service. Arizona Game and Fish Department, Phoenix.

Carlson, C.A., and R.T. Muth. 1989. The Colorado River:lifeline of the American Southwest. Pages 220-239 in D.P. Dodge, ed. Proceedings of the International Large Rivers Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences 106.

Carothers, S.W., and C.O. Minckley. 1981. A survey of the fishes, aquatic invertebrates, and aquatic plants of the Colorado River and selected tributaries from Lee's Ferry to Separation Rapid. Report to Bureau of Reclamation, Boulder City, Nevada. Museum of Northern Arizona, Flagstaff. 401pp.

Clarkson, R.W., E.D. Creef, and D.K. McGuinn-Robbins. 1993. Movements and habitat utilization of reintroduced razorback suckers (Xyrauchen texanus) and Colorado squawfish (Ptychocheilus lucius) in the Verde River, Arizona. Completion report to U.S. Fish and Wildlife Service on Project E5-4, Job 7, title VI of the Endangered Species Act. Arizona Game and Fish Department, Phoenix. 34pp.

Dill, W.A. 1944. Fishery of the lower Colorado River. California Fish and Game 30(3):109-211.

Edwards, G.B. 1974. Biology of the striped bass, Morone saxatilis (Walbaum), in the lower Colorado River (Arizona-California-Nevada). Masters Thesis, Arizona State University. 45pp.

Hendrickson, D.A. 1993. Evaluation of the razorback sucker (Xyrauchen texanus) and Colorado squawfish (Ptychocheilus lucius) reintroduction programs in central Arizona based on surveys of fish populations in the Salt and Verde rivers from 1986 to 1990. Nongame and Endangered Wildlife Program Report. Arizona Game and Fish Department, Phoenix. 166pp.

Jonez, A. and R.C. Sumner. 1954. Lakes Mead and Mohave Investigations. Nevada Fish and Game Commission Wildlife Restoration Division Project F-1-R. 186pp.

Joseph, T.W., J.A. Sinning, R.J. Behnke, and P.B. Holden. 1977. An evaluation of the status, life history and habitat requirements of endangered and threatened fishes of the Upper Colorado River System. U.S. Fish and Wildlife Service, FWS/OBS-77/2. Fort Collins, Colorado.

Langhorst, D.R. 1988. A monitoring study of razorback sucker, (Xyrauchen texanus) reintroduced into the lower Colorado River in 1987. Final report to California Department of Fish and Game contract C-1888. 76pp.

Liles, T.A. 1988. Lake Mohave Fish Management Report 1983-1987. Statewide Fisheries Investigation, Survey of Aquatic Resources. Federal Aid Project F-7-R-30. Arizona Game and Fish Department, Phoenix. 31pp.

Loudermilk, W.E. and L.C. Ulmer. 1985. A fishery inventory with emphasis on razorback sucker (Xyrauchen texanus) status in the lower Colorado River. Report to U.S. Fish and Wildlife Service under cooperative agreement 14-16-0002-80-921. California Department of Fish and Game, Fresno. 272pp.

Maddux, H.R., L.A. Fitzpatrick, and W.R. Noonan. 1993. Colorado River Endangered Fishes Critical Habitat: draft Biological Support Document. U.S. Fish and Wildlife Service, Salt Lake City, Utah. 225pp.

Marsh, P.C., and J.E. Brooks. 1989. Predation by Ictalurid catfishes as a deterrent to re-establishment of hatchery-reared razorback suckers. The Southwestern Naturalist 34(2):188-195.

_____ and W.L. Minckley. 1985. Aquatic resources of the Yuma Division, lower Colorado River. Final report, Bureau of Reclamation contract 2-07-30-X0214. Arizona State University, Tempe.

_____ 1987 Aquatic resources of the Yuma Division, lower Colorado River. Final report for Phase II, Bureau of Reclamation contract 2-07-30-X0214. Arizona State University, Tempe.

_____ 1991. Status of the bonytail chub (Gila elegans) and razorback sucker (Xyrauchen texanus) in Lake Mohave. Pages 18-23 in D.A. Hendrickson, ed. 1991 Annual Symposia. Proceedings of the Desert Fishes Council Volume XXIII.

_____ and D. Papoulias. 1989. Ichthyoplankton of Lake Havasu, a Colorado River impoundment, Arizona-California. California Fish and Game 75, 68-73 in Minckley, W.L., P.C. Marsh, J.E. Brooks, J.E. Johnson, and B.L. Jensen. 1991. Management toward recovery of the razorback sucker (Xyrauchen texanus). Pages 303-357 in W.L. Minckley and J.E. Deacon, editors. Battle Against Extinction. University of Arizona Press, Tucson.

McCall, T. 1980. Fishery investigation of Lake Mead, Arizona-Nevada, from Separation Rapids to Boulder Canyon, 1978-79. Contract 8-07-30-X0025, Final report to Water and Power Resources Service, Boulder City, Nevada. in W.L. Minckley. 1983. Status of the razorback sucker Xyrauchen texanus (Abbott), in the lower Colorado River Basin. The Southwestern Naturalist 28(2):165-187.

Miller, R.R. 1959. Origins and affinities of the freshwater fish fauna if western North America. pages 187-222 in C.L. Hubbs, ed. Zoogeography. Publication 51(1958). American Association for the Advancement of Science. Washington, D.C.

_____ 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts and Letters XLVI:365-404.

Minckley, W.L., 1979. Aquatic habitats and fishes of the lower Colorado River, southwestern United States. Contract 14-06-300-2529 for Bureau of Reclamation, Boulder City, Nevada. Arizona State University, Tempe. 478pp.

_____ 1983. Status of the razorback sucker Xyrauchen texanus (Abbott), in the lower Colorado River Basin. The Southwestern Naturalist 28(2):165-187.

_____ and J.E. Deacon. 1968. Southwestern fishes and the enigma of "endangered species." Science 159:1424-1432.

_____ P.C. Marsh, J.E. Brooks, J.E. Johnson, and B.L. Jensen. 1991. Management toward recovery of the razorback sucker (Xyrauchen texanus). Pages 303-357 in W.L. Minckley and J.E. Deacon, editors. Battle Against Extinction. University of Arizona Press, Tucson.

Moffett, J.W. 1943. A preliminary report on the fishery of Lake Mead. Transactions of the North American Wildlife Conference 8, 179-186.

Osmundson, D.B. 1987. Growth and survival of Colorado squawfish (Ptychocheilus lucius) stocked in riverside ponds, with reference to largemouth bass (Micropterus salmoides) predation. Masters Thesis, Utah State University, Logan.

_____ and L.R. Kaeding 1989. Studies of Colorado squawfish and razorback sucker use of the "15-mile reach" of the Upper Colorado River as part of conservation measures for the Green Mountain and Ruedi Reservoir water sales. Final Report. U.S. Fish and Wildlife Service. Grand Junction, Colorado.

Paulson, L.J., J.R. Baker, and J.E. Deacon. 1980. The limnological status of Lake Mead and Lake Mohave under present and future powerplant operations of Hoover Dam. Contract 14-06-300-2218 for Bureau of Reclamation, Boulder City, Nevada. Lake Mead Limnological Research Center, University of Nevada, Las Vegas. Technical Report No. 1. 229pp.

Priscu, J.C. Jr. 1978. Primary productivity and related limnological factors in Lake Mohave (Colorado River). Masters Thesis, University of Nevada, Las Vegas. 154pp.

Ridley, J.E., and J.A. Steel. 1975. Ecological aspects of river impoundments. pages 565-587 in B.A. Whitton, ed. River Ecology. University of California Press, Berkeley and Los Angeles. in W. L. Minckley, 1979. Aquatic habitats and fishes of the lower Colorado River, southwestern United States. Contract 14-06-300-2529 for Bureau of Reclamation, Boulder City, Nevada. Arizona State University, Tempe. 478pp.

Roden, D.L. 1978. Base Fisheries Data. Phase I. Boulder Canyon to Davis Dam. Report for Water and Power Resources Service, Boulder City, Nevada. Nevada Fish and Game. in U.S. Fish and Wildlife Service. 1981. Aquatic Study: Colorado River from Lees Ferry to Southern International Boundary and selected tributaries, Arizona, California and Nevada. Report prepared for Water and Power Resources Service. U.S. Fish and Wildlife Service, Phoenix, Arizona. 278pp.

Roline, R.A. and D.M. Lieberman. 1984. Progress report on the lower Lake Havasu limnology and water quality study. Environmental Sciences Section to Applied Science Branch (referral 85-2-2). Bureau of Reclamation, Denver, Colorado.

Sigler, W.F., and R.R. Miller. 1963. Fishes of Utah. Utah State Department of Fish and Game, Salt Lake City, in Minckley, W.L., P.C. Marsh, J.E. Brooks, J.E. Johnson, and B.L. Jensen. 1991. Management toward recovery of the razorback sucker (Xyrauchen texanus). Pages 303-357 in W.L. Minckley and

J.E. Deacon, editors. Battle Against Extinction. University of Arizona Press, Tucson.

U. S. Bureau of Reclamation. 1983. Draft environmental impact statement, Hoover powerplant modification, Clark County, Nevada, Mohave County, Arizona.

_____ 1986. Central Arizona Project Granite Reef Aqueduct fishery investigations, progress report 1986. Arizona Projects Office, Phoenix.

_____ 1988. Central Arizona Project Granite Reef Aqueduct fishery investigations, progress report 1987. Arizona Projects Office, Phoenix.

U.S. Fish and Wildlife Service. 1980. Aquatic Study: Colorado River from Lees Ferry to Southern International Boundary and selected tributaries, Arizona, California and Nevada. Special report on distribution and abundance of fishes of the lower Colorado River. Report prepared for Water and Power Resources Service. U.S. Fish and Wildlife Service, Phoenix, Arizona. 157pp.

_____ 1981. Aquatic Study: Colorado River from Lees Ferry to Southern International Boundary and selected tributaries, Arizona, California and Nevada. Report prepared for Water and Power Resources Service. U.S. Fish and Wildlife Service, Phoenix, Arizona. 278pp.

_____ 1990. Bonytail Chub Recovery Plan. U.S. Fish and Wildlife Service, Denver Colorado. 35pp.

Wagner, R.A. 1955. Basic survey of Lake Mohave. Completion report, Project F-2-R-1. Wildlife Restoration Division, Arizona Game and Fish Department, Phoenix. 16pp.

Wallis, O.L. 1951. The status of the fish fauna of the Lake Mead National Recreation Area, Arizona-Nevada. Transactions of the American Fisheries Society 80:84-92.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Post Office Box 1306
Albuquerque, N.M. 87103

JUN 29 1994

In Reply Refer To:
Region 2/AES-SE

MEMORANDUM

To: Assistant Regional Director, Ecological Services, Region 2

From: Assistant Regional Director, Fisheries & Federal Assistance, Region 2

Subject: Fish Stocking From Service Hatcheries Into Waters of the Lower Colorado River (Lake Mead South)

Following our meeting of June 24, 1994, with the Regional Director, I am submitting a modification of our proposal to stock rainbow trout and channel catfish into waters of the Colorado River and adjacent impoundments. Information provided incorporates conservation features to conserve razorback sucker and bonytail populations in Lake Mohave. These features have been discussed with you in the process of reviewing a draft biological opinion, as permitted during the Section 7 consultation process (50 CFR 402.14).

As agreed with your staff, paragraph g of section 402.14 allows for the release of draft opinions to facilitate a more meaningful exchange of information. Review of draft opinions may result in development of revisions and workable solutions that conserve the species and ensure that the action is not likely to jeopardize listed species. I believe the modified program, as now proposed, is not likely to jeopardize the razorback sucker or bonytail chub populations that occur in Lake Mohave. I recommend these features, as part of the modified proposal, be recognized as contributing toward conservation and recovery of the two listed fish species. I believe these elements complement objectives contained in a draft management plan for the Lower Colorado River basin and support efforts by the Lower Colorado Ecosystem Team to more effectively manage the plant and animal resources of the Lower Colorado River.

The modified proposal calls for the following conservation elements to either be in place or be implemented during the next 5 years by the Service and cooperating agencies that manage the fish and wildlife resources in Lake Mohave:

1994 - Elements currently being conducted:

1. Annual census of adult razorback sucker population in Lake Mohave.

2. Capture of razorback sucker larvae and taking of eggs and milt to provide larvae to stock ephemeral ponds adjacent to Lake Mohave. Sufficient advanced

fingerlings (300 millimeter) will be provided to replace the aging razorback sucker population in Lake Mohave by the year 1999. All advanced fingerling will be marked or tagged before their release into Lake Mohave.

3. Provide 100 (+/-) millimeter bonytail chub for stocking into Lake Mohave; 1994 production will be provided from natural reproduction that occurs in broodstock ponds. Fingerlings will be placed into ephemeral ponds or other grow-out facilities for additional growth. At time of stocking, fish will be marked before being released into Lake Mohave.

1995 - Elements to be continued or implemented:

4. Continue element 1.

5. During the period November (94) through April (95), conduct surveys to determine presence of razorback sucker larvae in areas 1-5 before trout are stocked in impacted area. Trout will not be stocked in these areas if razorback fry are found. Stocking of rainbow trout in areas 6 and 7 may continue as in previous years.

6. Cooperate with State and Federal agencies to expand 1994 efforts to locate bonytail chub spawning areas in Lake Mohave.

7. Cooperate with State and Federal agencies to provide 10,000 marked razorback sucker advanced fingerlings (300 millimeter) annually to be stocked into Lake Mohave.

8. Initiate a program to provide 25,000 marked bonytail chub advanced fingerlings (250-300 millimeter) annually for stocking Lake Mohave.

9. In concert with State and Federal cooperators, prepare and implement a fisheries management plan for Lake Mohave.

1996 - Elements to be continued or implemented:

10. Continue elements 1, 5, 6, 7, and 9.

11. Implement stocking of 25,000 bonytail chub advanced fingerlings (250-300 millimeter).

1997 - 1999 Elements to be implemented:

12. Continue implementation of elements 1, 5, 6, 7, 9, and 11.

13. Evaluate data collected annually. Recommend modifications that enhance effectiveness of each study and that collectively enhance recovery of the bonytail chub and razorback sucker. A report of accomplishments and recommendations will be provided to the Regional Director annually.

It is understood that rearing 300 millimeter razorback suckers and 250-300 millimeter bonytail chub may take 2 to 3 years and that rearing may be affected by circumstances beyond the Service's control; therefore, the number of fish provided for stocking could differ from year to year.

PAT LANGLEY